

DETAILED ACTION

1. Claims 1-8, 10-25, 27-49 are allowed over the prior art of record.

Examiner's Amendment

2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Brian Gustafson on 03/26/09 at 2:00PM.

The application has been amended as follows:

Claim 1: Add on line 20, --, using a computer, -- after the word "rendering" and before the phrase "the image using the adjusted color information".

Claim 17: Add on the last line, --, using a computer, -- after the word "rendering" and before the phrase "the image using the adjusted color information".

Claim 34: Add on line 20, -- the -- after the phrase "calculate a gamma value that is used to adjust" and before the phrase "color information of an image".

On line 21, remove "an" in the phrase "color information of an image". Add, -- the -- between "color information of" and "image" of the above phrase.

Add **new claims 35-49** as follows:

35. A system comprising:

- one or more computers configured to perform operations including:
 - receiving an image having color information;
 - receiving a transfer function, wherein the transfer function specifies a set of output values corresponding to a set of input values;
 - iteratively, until a termination flag is set:
 - receiving a first power law function;
 - generating an auxiliary function including modifying the transfer function using local differences between the transfer function and the first power law function;
 - defining a second power law function by fitting a power law function to the auxiliary function;
 - calculating a modelling error between the second power law function and the transfer function, wherein the modelling error is an error value obtained from local differences between the second power law function and the transfer function;
 - providing the second power law function as the first power law function for the next iteration when the modelling error is greater than or equal to a predetermined value; and
 - setting the termination flag when the modelling error is less than the predetermined value;
 - using the second power law function to calculate a gamma value that is used to adjust the color information of the image; and
 - rendering the image using the adjusted color information,
- where in a first iteration, the first power law function is defined by fitting a power law function to the transfer function.

36. The system of claim 35, where modifying the transfer function using local differences includes determining a difference for one or more input values between the transfer function and the first power law function.

37. The system of claim 35, where modifying the transfer function using local differences includes determining one or more closest points between the transfer function and the first power law function without regard for the input value associated with the respective points.

38. The system of claim 35, further configured to perform operations comprising:
counting the number of iterations; and
setting the termination flag when the number of iterations exceeds a maximum number of iterations.

39. The system of claim 35, wherein:
the transfer function is a transfer function for gamma correction, and the first and second power law functions are power law functions having a form of cx^β , wherein x is the input variable of the power law functions, and c and β are real numbers.

40. The system of claim 39, wherein:
fitting the second power law function to the auxiliary function includes fitting a linear function to a logarithmic representation of the auxiliary function.

41. The system of claim 40, wherein:
fitting the linear function to the logarithmic representation of the auxiliary function includes minimizing a least square error between the linear function and the logarithmic representation of the auxiliary function.

42. The system of claim 1, further configured to perform operations comprising:
using a modifying parameter to weight the local differences between the transfer function and the first power law function, and using the weighted local differences to generate the auxiliary function from the transfer function.

43. The system of claim 42, further configured to perform operations comprising:

generating a plurality of second auxiliary functions from the transfer function, the first power law function and a corresponding plurality of modifying parameters, wherein each auxiliary function is generated by weighting the local differences between the transfer function and the first power law function using a corresponding one of the plurality of modifying parameters;

fitting each of the plurality of second auxiliary functions to generate a respective plurality of second power law functions, where each of the plurality of second power law functions corresponds to one of the plurality of modifying parameters;

calculating a plurality of modelling errors between the transfer function and each of the plurality of second power law functions, wherein each of the modeling errors corresponds to one of the plurality of modifying parameters;

executing a minimization procedure to determine a value of a particular modifying parameter of the plurality of modifying parameters that minimizes the modelling error,

using the value of the particular modifying parameter that minimizes the modelling error to weight the local differences between the transfer function and the first power law function;
and

generating the auxiliary function using the particular modifying parameter, the transfer function, and the first power law function.

44. The system of claim 43, wherein executing the minimization procedure comprises fitting a quadratic function to a distribution of modelling errors as a function of the plurality of modifying parameters.

45. The system of claim 43, wherein executing the minimization procedure comprises executing a golden search algorithm.

46. The system of claim 35, wherein: calculating the modelling error for the second power law function comprises calculating a total square error between the transfer function and the second power law function.

47. The system of claim 35, wherein: calculating the modelling error for the second power law function comprises calculating the maximum absolute difference between the transfer function and the second power law function.
48. The system of claim 35, wherein: receiving a transfer function comprises receiving a plurality of transfer function values.
49. The system of claim 35, wherein: receiving a transfer function comprises receiving a piecewise continuous monotonically increasing function.

Allowable Subject Matter

3. The following is a statement of reasons for allowance:

Applicants are disclosing a method, system, and apparatus for adjusting the color information of an image by modeling a non-linear transfer function with a power law function and a computer program product, implemented on a machine readable storage device, for adjusting the color information of an image by modeling a non-linear transfer function with a power law function (wherein the color information is color values of pixels, page 7, lines 17-22), the computer program product comprising instructions operable to cause a programmable processor to: receiving a transfer function, wherein the transfer function specifies a set of output values corresponding to a set of input values; and iteratively, until a termination flag is set: receiving a first power law function and a second power law function; calculating a modeling error from the second power law function and the transfer function; and setting the termination flag when the modeling error is less than a predetermined value; and using the second power law function to calculate a gamma value that is used to adjust the color information of the image. This has been disclosed in the prior art of record.

The prior art of record does not disclose generating an auxiliary function including *modifying the transfer function using local difference between the transfer function and the first power law function*,

defining a second power law function by *fitting a power law function to the auxiliary function*, and calculating a modeling error between the second power law function and the transfer function.

The closest prior art uncovered during examination teaches certain limitations of the claimed invention as follows:

U.S. Patent No. 5,381,349, published by Winter et al. : Discloses a gamma correction method by fitting transfer functions and fitting a more accurate transfer function to the average of the first two function curves (**col. 4 lines 24-27, curve 32, 60, 62, 64 on FIG. 4-7**). However, Winter fails to disclose generating an auxiliary function including modifying the transfer function using local difference between the transfer function and the first power law function, defining a second power law function by fitting a power law function to the auxiliary function, and calculating a modeling error between the second power law function and the transfer function.

U.S. Patent No. 7,076,119, published by Takemoto: Discloses determining difference between curves (**col. 8 lines 19-20**) and using "curving fitting" method (**col. 8 lines 15-16**) using power law functions (**column 8, lines 23-38**), and calculating a modeling error (**column 4, lines 53-62**). However, Takemoto fails to disclose generating an auxiliary function including modifying the transfer function using local difference between the transfer function and the first power law function, defining a second power law function by fitting a power law function to the auxiliary function, and calculating a modeling error between the second power law function and the transfer function.

U.S. Patent Application Publication 2004/0267854, published by Haider et al.: Disclose a converter that performs a logarithmic conversion for input signal (a function) ([0077]-[0078]). However, Haider fails to disclose generating an auxiliary function including modifying the transfer function using local difference between the transfer function and the first power law function, defining a second power law function by fitting a power law function to the auxiliary function, and calculating a modeling error between the second power law function and the transfer function.

These features relating to the specific sequence of method steps, system, and apparatus components as noted above renders claims 1, 17, 34, and 35 non-obvious over the prior art of record.

Process claims 1-8, 10-16 are proper under 35 U.S.C. 101 as a specific machine is recited in the claim language (rendering using the computer within a computer-implemented method). The process claims are no longer preempting all possible practical applications of its algorithm as they are directed to a specific practical application (rendering the image using the adjusted color information).

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SUZANNE LO whose telephone number is (571)272-5876. The examiner can normally be reached on M-F, 8-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah can be reached on (571)272-2297. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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Examiner
Art Unit 2128

/SL/
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